Polar Code Hazard Identification Workshop Report:

Report for International Maritime Organisation (IMO)
Report No: v1

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1.0 Introduction

The International Maritime Organisation (IMO) is working with States and other interested stakeholders (such as Non-Government Organisations (NGOs)) to develop a mandatory Polar Code to control the expected increase in ship traffic in polar waters (the Arctic and the Antarctic) that results from climate change and other changes.

The Polar Code is intended to function alongside existing IMO conventions, such as SOLAS and MARPOL. One of its function is to augment “baseline” environmental protection of polar waters to reflect their increased environmental sensitivity. If certain specific locations within polar waters need further protection this will be provided by existing mechanisms separate from the Polar Code.

Det Norske Veritas Limited (DNV) was engaged by IMO to plan, perform and report on a hazard identification (Hazid) workshop in support of the development of the environmental aspects of the Polar Code. The intention is to use the Hazid process and outputs as the foundation for the IMO “Polar Code” for shipping operations in polar waters. The main objective of the workshop was to identify all the technical issues relevant to the Polar Code (routine and accidental releases from ships into the environment, potential causal factors for accidental releases and potential controls).

This report describes the planning, execution and outputs of the workshop, including tasks performed immediately after the workshop. It consists of

- Section 2, which describes the scope and objectives of the workshop.
- Section 3, which describes the purpose of the workshop relative to the preparation of the Polar Code. It also states how the workshop outputs should be interpreted both from a wider Polar Code formulation point of view and from the more technical perspective that generic statements concerning harm or causes will always depend on the exact circumstances of an incident (its context).
- Section 4, which describes why the polar regions are special and need additional protection by the Polar Code.
- Section 5, which describes the workshop process and references the workshop outputs which are included in full in the Appendices.
- Section 6, which briefly summarises the report and describes some identified areas where additional information or systems could be used to increase safety and/or reduce environmental impacts from shipping in polar waters.

Four appendices document the detailed outputs.

2.0 Scope and Objectives

The scope of the workshop was to identify:

- Routine releases of materials into the environment. This includes both continuous releases and intermittent releases that are consistent with normal ship operating procedures.
- Accidental releases of materials into the environment. The main focus will be on navigational accidents to ships (collisions, groundings, etc.).
Any other cause of potentially significant release of material into the environment or any other type of environmental impact caused by the presence of shipping.

The following were not part of the scope of the workshop, but may be addressed within the Polar Code by other processes:

- Special measures to protect a specific location within polar waters. Such measures, if required, will be addressed by existing IMO mechanisms such as Particularly Sensitive Sea Areas (PSSAs).
- Oil and gas exploration and production activities, including both fixed and floating installations and seismic surveys.
- Intentional but illegal acts, such as illegal discharges or criminal activity (e.g. piracy, terrorism). These issues are addressed by enforcement and security respectively.

The main objectives of the workshop were to:

- Identify all potential hazards, hazard causes, hazard consequence modification factors and safeguards that apply in the polar waters, or are of particular concern. The main goal of the exercise was to achieve completeness, and not to be concerned about relative importance.
- Develop and agree causal relationships between the factors identified using bow-tie models (a bow tie is a risk analysis tool that links basic causes to accident consequences and response options, see Appendix I).
- Discuss and agree the main contributing factors to risk that arise due to conditions in the polar waters.
- Agree the priorities for safeguards (risk controls) that should be applied. These would provide the technical input to be considered when drafting the proposed Polar Code.

Due to limitations of time the workshop did not address all the above objectives.

3.0 Purpose, Interpretation and Context

It is important to clearly state that the purpose of the workshop was not to form conclusions or to make recommendations on which issues are more important, on which controls should be implemented and on how the Polar Code should be written. These are subsequent steps which will be performed within the normal IMO process. This subsequent process may, or may not, make reference to the outputs of this workshop.

The purpose of the workshop was to bring stakeholders together to identify and, if possible, to agree all factors of importance to the formulation of a risk-based Polar Code, and to structure these outputs in a manner that is consistent with a risk assessment. Where differences of opinion exist, these have been documented as far as possible. By addressing all factors of importance, and not just discussing differences of opinion, it is hoped that stakeholders will better appreciate their commonality and that this will promote progress towards consensus and the early adoption of an agreed Polar Code.

The outputs of the workshop process are a structured list of key issues. No distinction was made between the Arctic and the Antarctic in the workshop, although it was acknowledged that there are significant differences between the two regions, see Section 4.
Finally it is noted that in any generic discussion of environmental impacts or of accident causes it will inevitably involve assumption and approximation. As a result, there will be circumstances where, for example, an environmental impact is either less than or greater than noted in this report. The exact impact will depend on the exact conditions of the release and the exact conditions in the receiving environment (which together may be described as the context of the release). That is, the workshop outputs describe possible consequences and causes and do not imply that these consequences and causes will always apply (or that other factors not noted are not also applicable in some circumstances).

4.0 Factors that make the Polar Waters Special

4.1 Arctic and Antarctic Waters

Whilst the Polar Code is intended to be equally applicable to both Arctic and Antarctic waters the differences between the two poles were discussed at the workshop and are briefly noted here.

- The Arctic is a shallow sea sometimes covered by multi-year ice (more compacted, harder) or single-year ice and surrounded by land masses. The Antarctic is an ice covered continent which is surrounded by a deep ocean.
- The Arctic has been home to native peoples, who have made their living from the environment, for thousands of years. The Antarctic has no permanent population of people.
- The Arctic is currently less protected by international law compared to the Antarctic.

Clearly there are many other differences, particularly relating to the flora and fauna that live in the Arctic and the Antarctic.

4.2 Special Release Impact Factors that apply in Polar Waters

Any release of material (solids, liquids or gases, routine or accidental release) or energy (e.g. sound or light) into the environment has the potential to cause an environmental impact. The following factors that make polar waters special compared to other waters were noted during the workshop:

- Cold sea and cold air. This mainly affects release consequences by reducing the rates of chemical and biological processes, so releases are destroyed by natural processes more slowly compared to warmer environments.
- The presence of floating ice may result in longer range transport of discharged materials or non-indigenous species compared to ice-free environments.
- Seasonal variations are greater in polar regions than elsewhere.
- Polar region ecosystems are well-adapted to the polar environment and may not be able to adapt to changes to the environment (unique vulnerability).
- The Antarctic in particular is seen as an unspoiled, pristine environment with a low human footprint.
- Polar regions have low atmospheric interchange and historically have a low rate of change.
• Polar waters are generally remote which makes response more difficult and slower. This list is not intended to be exhaustive.

4.3 Special Influences on Accidents and Accident Causes that apply in Polar Waters

The factors unique to polar waters that might affect the frequency of accidents were discussed at the workshop and noted as follows:

• Long polar days and long polar nights, which can disrupt sleep patterns and influence human error rates.
• Polar water charts may be insufficiently detailed or out of date. Some sea areas may be newly navigable due to reduced sea ice.
• Knowledge of local oceanographic conditions (e.g. currents) may be limited.
• Availability and/or interpretation of meteorological data and forecasts may be more challenging and might require local experience or expertise.
• Equipment that fails, or back-up equipment that fails on demand, because of extreme cold or ice.
• Ship stability problems due to extreme icing on ship’s superstructure.
• Remoteness or proximity to magnetic poles may result in some systems not functioning as specified (e.g. compass, gyro, INMARSAT communication reliability or reduced download speeds).
• Sea ice collision (physical damage to ship by ice impact) and glacial ice waves caused by calving (ship stability).
• Remoteness of polar waters and extreme cold makes ships’ repairs more difficult (e.g. use of hand tools whilst wearing cold weather clothing).
• Remoteness also limits infrastructure support, such as ports or shore based navigation support (lighthouses, beacons, vessel traffic services).
• High wind speeds may be more frequent and more sustained. In the Southern Ocean this may lead to more frequent severe sea states (infinite fetch between Australasia and Antarctica).
• Possible extended areas of restricted visibility in Arctic regions.
• Localised extreme and rapidly variable weather conditions e.g. Katabatic winds (high speed wind falling from the polar plateau).

It was also discussed that in polar waters ship navigation is mainly performed with reference to:

• Primary radar to detect distance to shore, relative position of other ships and detection and relative position of icebergs).
• Global Positioning Systems (GPS) for absolute definition of own ship’s position, combined with charts for the identification of hazards.
• Echo sounders for water depth and perhaps sonar for forward and lateral under-water ice or obstruction detection.
Finally it is noted that whilst each of the above factors noted in Section 4 may have limited significance in themselves, the combined significance of multiple factors could be greater than the sum of the parts (that is, synergistic effects may apply).

5.0 Workshop Process

This section summarises the workshop planning, execution and reporting process and references the main outputs that result.

5.1 Workshop Planning

On the basis of an initial discussion between DNV and IMO, DNV prepared a draft workshop plan. DNV and IMO then met to discuss the draft plan, and subsequently DNV revised the workshop plan and prepared the workshop checklist. Both documents were reviewed and agreed with IMO and are included in Appendix I.

5.2 Workshop Execution

DNV then facilitated and recorded the workshop according to the agreed plan. All workshop notes were displayed to all workshop participants using a projector so that the points recorded could be discussed, challenged and refined during the workshop.

The stages of the workshop consisted of:

1. A short PowerPoint presentation to provide a brief introduction to the workshop.

2. Brainstorm Session 1 (Environmental Impacts)
   This aimed to identify all environmental impacts that could result from shipping in polar waters.
   
   A brainstorm list was produced which was subsequently categorised by DNV and circulated to all participants. Comments received from participants were included by DNV and the result is shown in Appendix II, Section 1.

3. Brainstorm Session 2 (Risk Controls)
   This aimed to identify all potential hazard causes and hazard consequence modification factors and hazard safeguards (or risk controls) that could apply in the polar waters. The session mainly focussed on risk controls.
   
   A brainstorm list was produced which was subsequently categorised by DNV and circulated to all participants. Comments received from participants were included by DNV and the result is shown in Appendix II, Section 2.

4. Analysis of Hazards Session
   Selected hazards were taken in turn from the list developed in the first brainstorm session. For impacts that result from routine operations only the consequences of the hazard were analysed, but for accidents the main emphasis was on how accidents could be prevented. The majority of the workshop time available was taken by this session.
A draft hazard analysis table was produced which was subsequently edited for clarity by DNV and circulated to all participants. Comments received from participants were included by DNV and the result is shown in Appendix II, Section 3.

5. Brainstorm Session 3 (Benefits of Increased Shipping in Polar Regions)
This aimed to identify the main benefits of increased shipping in polar waters. This is an important item to provide balance to the workshop process. If there are limited or no benefits then the increased risks identified might be hard to justify.

A brainstorm list was produced which was edited for clarity by DNV and circulated to all participants. Comments received from participants were included by DNV and the result is shown in Appendix II, Section 3.

6. Brainstorm Session 2 (Workshop Process Improvement)
This aimed to identify suggestions for improvement of the workshop process.

A brainstorm list was produced which was edited for clarity by DNV and circulated to all participants. Comments received from participants were included by DNV and the result is shown in Appendix II, Section 4.

DNV and IMO closed the workshop by thanking all participants for their attendance and their contributions.

It should be noted that when comments on workshop outputs were requested from workshop participants it was emphasised that comments made that added to, or amended, the meaning of what was discussed during the workshop would be rejected. However, some additional points of dispute were added to the hazard analysis tables during post-workshop review. These are introduced by “Post-workshop note:” to show that they were not debated during the workshop.

Workshop participants were also invited, at their discretion, to submit a separate document with any additional comments or statements of opinion on the workshop outputs. These documents have been included in Appendix IV of this report.

5.3 Post-Workshop Tasks and Reporting
After the Workshop DNV edited the workshop outputs for clarity and structure and circulated them to the workshop participants for comment, as described in Section 5.2 above.

DNV also generated this draft report to describe the workshop process and the resulting outputs.

Furthermore, during the workshop it became clear that there would not be time to discuss the main hazards during the workshop. It was, therefore agreed, that DNV would complete the analysis of hazards and propose the outputs to IMO for comment. This output is included in Appendix III.

All comments received were then assimilated into this draft report by DNV and the report was sent to IMO. This is the current position of this work.
6.0 Summary

A workshop was held to discuss and document the factors that influence all types of environmental impacts in polar waters, and the factors that influence the frequency of accidents to shipping in polar waters. These outputs are recorded in detail in the appendices of this report.

The workshop also identified a “wish list” of future information or system requirements. These are listed here.

- There is a need for more detailed knowledge of the acute and chronic toxicity effects on polar organisms, and a need for better understanding of possible persistence and biomagnification processes in polar waters.
- There is a need for better understanding of how ship noise might affect marine animals that use sound for communication or navigation (e.g. location of breathing holes in ice), and how this impact might vary with increasing ship traffic levels. This was disputed as some stakeholders considered enough information was available for decision making.
- There is a need for better understanding of how ship-animal collisions occur and what can be done to reduce their frequency. This was disputed as some stakeholders considered enough information was available for decision making.
- Some stakeholders would like better information (more complete, more detailed, better spatial and temporal resolution) of shipping movements (routes and movement frequencies) in polar waters. This was disputed.
- More reliable communication, and faster data transfer speeds, in polar regions would enable the provision of up-to-date information and forecasts to support better decision making on ships in polar waters.
- Ships in polar waters should be able to get better real-time information and forecasts of weather, sea currents, presence of migratory species, locations of wildlife colonies, etc. so that they can plan safer navigation with reduced environmental impact.
- There is a need for more consistent reporting of incidents and accidents in polar waters with special emphasis on structural failures onboard ships.

This workshop report is submitted to IMO for their comments and to support the formulation of the IMO Polar Code.
Appendix I : DNV Workshop Support Documents

This appendix contains two documents which are included to record the workshop process:

- First is the Workshop Briefing Material which was distributed to workshop participants prior to the workshop. Its purpose was to familiarise all participants with the objectives and proposed process for the workshop.
- Second is the hazard checklist which was distributed to workshop participants during the workshop. Its purpose was to help stimulate additional ideas for hazards, hazard causes and hazard consequences in order to help ensure the process outputs were complete.

Both documents are included as previously distributed (no post-workshop editing has been performed) for the record.
International Maritime Organisation
Polar Code Hazard Identification Workshop

Background

The International Maritime Organisation (IMO) is working with States and other interested stakeholders (such as Non-Government Organisations (NGOs)) to develop a mandatory Polar Code to control the expected increase in ship traffic in polar waters (the Arctic and the Antarctic) that results from climate change and other changes.

The Polar Code is intended to function alongside existing IMO conventions, such as SOLAS and MARPOL. One of its functions is to augment “baseline” environmental protection of polar waters to reflect their increased environmental sensitivity. If certain specific locations within polar waters need further protection this will be provided by existing mechanisms separate from the Polar Code.

Det Norske Veritas Limited (DNV) is engaged by IMO to plan, perform and report a hazard identification (Hazid) workshop in support of the development of the environmental protection aspects of the Polar Code. DNV understands the intention is to use the Hazid process and outputs as the foundation for the environmental protection aspects of the IMO Polar Code for shipping operations in polar waters. (Note the scope of the Polar Code is broader than environmental protection, but the scope of this workshop is restricted to environmental protection.)

This document presents the workshop plan prepared by DNV. The main objective of the workshop is to identify all the technical issues relevant to the Polar Code (routine and accidental releases from ships into the environment, potential causal factors for accidental releases and potential controls) and, if there is time available, to rank the importance of each. It is not anticipated that within the workshop decisions will be made about which controls should be implemented and how the Polar Code should be written. These are subsequent steps.

The purpose of this document is to describe the workshop process, so that IMO can comment upon it to ensure it meets their needs, and also for the final document to be distributed to workshop participants to serve as an introduction to the workshop.

(DNV is aware that this group has already developed a draft hazard matrix. This will be used during this workshop.)

Scope

The scope of the Hazid is to identify:

- Routine releases of materials into the environment. This includes both continuous releases and intermittent releases that are consistent with normal ship operating procedures.
- Accidental releases of materials into the environment. The main focus will be on navigational accidents to ships (collisions, groundings, etc.).
- Any other cause of potentially significant release of material into the environment.

The following are not part of the scope of the Hazid:
- Special measures to protect a specific location within polar waters. Such measures, if required, will be addressed by existing IMO mechanisms such as Particularly Sensitive Sea Areas (PSSAs).
- Oil and gas exploration and production activities, including both fixed and floating installations.
- Intentional but illegal acts, such as illegal discharges or criminal activity (e.g. piracy, terrorism). These issues are addressed by enforcement and security respectively.

**Definitions**

Risk analysts apply specific meanings to certain words and phrases as defined below. These definitions are taken from IMO’s Formal Safety Assessment (FSA) guidance documents.

- **Accident.** An unintended event involving fatality, injury, ship loss or damage, other property loss or damage, or environmental damage.
- **Accident category.** A designation of accidents reported in statistical tables according to their nature, e.g. fire, collision, grounding, etc.
- **Consequence.** The outcome of an accident.
- **Frequency.** The number of occurrences per unit time (e.g. per year).
- **Hazard.** A potential to threaten human life, health, property or the environment.
- **Risk.** The combination of the frequency and the severity of the consequence.
- **Risk control measure (RCM).** A means of controlling a single element of risk.
- **Risk control option (RCO).** A combination of risk control measures.

Risk analysts sometime build risk models called bow-ties. A bow-tie links a fault tree to an event tree via a central hazard or accident category. A generic example is shown below.
The bow-tie links causes on the left to different accident outcomes on the right. The path that links these is sometimes called a causal chain. Typically accident causes will include immediate causes (e.g. human misjudgement, technical failure) and basic causes (e.g. poor training, poor maintenance).

In this document “polar waters” are as defined by IMO in the draft Polar Code and shown below.

![Figure 1 - Maximum extent of Arctic waters application (see paragraph G-3.5)](image1)

![Figure 2 - Maximum extent of Antarctic Waters application (see paragraph G-3.4)](image2)

To enhance mutual understanding, additional terms may be defined during the workshop.

**Routine Releases into the Environment**

One objective of the workshop is to identify all potentially significant sources of releases into the environment from ships, such as combustion gases from main engines.
Accidental Releases and High Level Navigational Hazards

Another workshop objective is to identify releases into the environment that result from navigational accidents and any other potentially significant releases into the environment.

DNV’s initial expectation is that the high level navigational hazards in polar waters are the same as in non-polar waters. The difference is that in polar water there are factors that can enhance the frequency and/or the consequence of these hazards. The high level hazards are:

- Ship-ship collision.
- Powered grounding (a ship that grounds due to human error or technical failure when its main propulsion and steering are fully functional).
- Drift grounding (a ship that grounds due to mechanical failure of main propulsion and/or steering and the combination of waves, wind, current and proximity to shallow water).
- Structural failure/ foundering whilst underway (structural failure is when a ship’s hull is damaged by the waves and foundering is when the ship’s stability or structure is damaged by water ingress into the hull but not through the hull).
- Fire or explosion whilst underway.
- Powered allision or contact (like powered grounding but contact with a man-made object like an oil platform or wind turbine).
- Drift allision or contact (like drift grounding but contact with a man-made object like an oil platform or wind turbine).

The above high level hazards are, DNV believe, the main navigational accident types that can result in spill. Note, that the defining characteristics of polar waters introduce new or modified accident causes. Thus ice crushing is a cause of structural failure, ice on the super-structure is a cause of foundering, brittleness of steel due to cold is a cause of structural failure, reduced performance of navigational aids is a cause of collision or powered grounding or powered allision.

Detailed Meeting Objectives

These are to:

- Identify all potential hazards, hazard causes, hazard consequence modification factors and safeguards that apply in the polar waters, or are of particular concern. The main goal here is to achieve completeness, and not to be concerned about relative importance.
- Develop and agree causal relationships between the factors identified using bow-tie models (a bow tie is a risk analysis tool that links basic causes to accident consequences and response options).
- Discuss and agree the main contributing factors to risk that arise due to conditions in the polar waters.
- Agree the priorities for safeguards (risk controls) that should be applied. These would provide the technical input into the proposed Polar Code.

DNV will aim to keep all discussions at the technical level (e.g. what are the issues, what are the relative importances of issues).
Proposed Meeting Process and Outline Agenda

The outline below is the proposed approach for Day 2 onwards (the Day 1 programme is filled with presentations).

1. Introductions as required (perhaps just DNV personnel).
2. Presentation of risk concepts and definitions.
3. Brainstorm of hazards, causes, consequences, amplification factors, safeguards, etc. The aim is to get as many factors identified as possible.
4. Examination of checklists and further discussion to ensure completeness of factors identified under point 2.
5. Analysis of hazard consequences. This will be a more structured approach and will aim to develop qualitative causality relationships between hazards and their consequences. It will include the identification of relevant safeguards.
6. Analysis of hazard frequencies. This will be a more structured approach and will aim to develop qualitative causality relationships between hazards and their causes. It will include the identification of relevant safeguards. Together, items 5 and 6 are the basis for the bow-tie models.
7. Discussion and assessment of relative significance of factors identified. This might be difficult to do at the generic level, so we may need to define some scenarios and perform the assessment with reference to specific scenarios.
8. Identification of benefits of increased activity in polar waters. In most risk assessments, DNV aim to provide balance by both considering the risks but also the benefits.
9. Discussion of improvements to meeting process. DNV always seeks feedback on if we could have performed better.

It is planned that DNV will perform a limited amount of post-workshop work, mainly to tidy up the workshop outputs prior to transmission to IMO.

Example Definitions for Likelihood and Severity

In IMO’s FSA guidance the terms below are defined to assist the ranking of frequency and consequence.

Also given below is a table from MEPC that defines severity categories.

These tables may be used to support item 7 in the above outline agenda. Alternatively the meeting may prefer to develop its own definitions of severity and/ or risk.
Tables from FSA guidance.

### Severity Index

<table>
<thead>
<tr>
<th>SI</th>
<th>SEVERITY</th>
<th>EFFECTS ON HUMAN SAFETY</th>
<th>EFFECTS ON SHIP</th>
<th>S (Equivalent fatalities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor</td>
<td>Single or minor injuries</td>
<td>Local equipment damage</td>
<td>0.01</td>
</tr>
<tr>
<td>2</td>
<td>Significant</td>
<td>Multiple or severe injuries</td>
<td>Non-severe ship damage</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>Severe</td>
<td>Single fatality or multiple severe injuries</td>
<td>Severe damage</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Catastrophic</td>
<td>Multiple fatalities</td>
<td>Total loss</td>
<td>10</td>
</tr>
</tbody>
</table>

4. The following table gives an example of a logarithmic probability/frequency index.

### Frequency Index

<table>
<thead>
<tr>
<th>FI</th>
<th>FREQUENCY</th>
<th>DEFINITION</th>
<th>F (per ship year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Frequent</td>
<td>Likely to occur once per month on one ship</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Reasonably probable</td>
<td>Likely to occur once per year in a fleet of 10 ships, i.e. likely to occur a few times during the ship’s life</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>Remote</td>
<td>Likely to occur once per year in a fleet of 1000 ships, i.e. likely to occur in the total life of several similar ships</td>
<td>$10^{-2}$</td>
</tr>
<tr>
<td>1</td>
<td>Extremely remote</td>
<td>Likely to occur once in the lifetime (20 years) of a world fleet of 5000 ships</td>
<td>$10^{-5}$</td>
</tr>
</tbody>
</table>

5. The following table gives an example of a risk matrix based on the tables above.

### Risk Index (RI)

<table>
<thead>
<tr>
<th>FI</th>
<th>FREQUENCY</th>
<th>SEVERITY (SI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Frequent</td>
<td>Minor</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Reasonably probable</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Remote</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>Extremely remote</td>
<td>2</td>
</tr>
</tbody>
</table>

Table from MEPC.

### Severity Index

<table>
<thead>
<tr>
<th>SI</th>
<th>SEVERITY</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Category 1</td>
<td>Oil spill size &lt; 1 tonne</td>
</tr>
<tr>
<td>2</td>
<td>Category 2</td>
<td>Oil spill size between 1-10 tonnes</td>
</tr>
<tr>
<td>3</td>
<td>Category 3</td>
<td>Oil spill size between 10-100 tonnes</td>
</tr>
<tr>
<td>4</td>
<td>Category 4</td>
<td>Oil spill size between 100-1,000 tonnes</td>
</tr>
<tr>
<td>5</td>
<td>Category 5</td>
<td>Oil spill size between 1,000-10,000 tonnes</td>
</tr>
<tr>
<td>6</td>
<td>Category 6</td>
<td>Oil spill size &gt;10,000 tonnes</td>
</tr>
</tbody>
</table>
International Maritime Organisation
Polar Code Hazard Identification Workshop

This checklist is prepared to promote the complete identification of:

- All potentially significant releases into the environment from shipping as a result of routine operations and navigational accidents.
- All significant factors that might increase or decrease the amount of material released into the environment, or might increase or decrease the impact of releases on the environment in polar waters.
- All potential risk controls (measures or options) that could be applied to reduce or eliminate the frequency of releases, or to reduce or eliminate the consequences of releases.

The lists are not intended to be exhaustive. They are presented to try to stimulate additional issues that might not otherwise have been identified.

Also appended is the Hazard Matrix Rev1.1 which was previously prepared by the IMO working group. This describes important issues previously identified.

Possible Routine Releases into the Environment
- Combustion gases from main power plant (e.g. oxides of nitrogen, oxides of sulphur, oxides of carbon, unburnt and partially burnt hydrocarbons, soot, ash, etc.).
- Combustion gases from ancillary plant, such as incinerators (dioxins, poly chlorinated biphenyls (PCBs)), inert gas generators, etc.
- Fugitive Volatile Organic Compounds (VOCs) from cargo and fuel tanks.
- Liquid waste from accommodation blocks (dirty water, sewage, etc.).
- Food waste and other solid waste from accommodation blocks.
- Liquid waste from bilge.
- Ballast water exchange.
- Greases or lubricants, for example from main propulsion or steering systems.
- Anti-fouling paints from ship hulls.

Possible Accidental Releases into the Environment
- Cargo from damaged cargo tanks or compartments.
- Cargo containers that have fallen overboard.
- Bunker fuel oil from fuel oil tanks.

Contributing Factors
- Ice bergs as collision hazard.
- Ice bergs as ship crush hazard (structural failure).
- Ice on ship superstructure (loss of stability, foundering).
- Extreme cold leading to brittleness of metal (structural failure).
- Extreme cold or icing leading to technical failure of equipment, including emergency or backup equipment that might fail on demand due to extreme cold or icing.
- Poor communications.
- Long response times and limited response capability.
• Weak or non-existent conventional navigational aids (lights, distinguishable features for bearings, etc.)?
• Poor charts?

Other issues to be considered?
• High latitude effects on navigation systems (lack of GPS, cosmic radiation effects)?
• Variations of magnetic north/ south?
• Long days or long nights resulting in interrupted sleep patterns, loss of alertness, poor decision making?
• Weak primary radar returns from icy shorelines?
• Difficulty of distinguishing sea ice from wave clutter with primary radar?
• Effect of cold water on spilled materials?
• Extremely low visibility or low visibility for long periods of time?
• Extreme sea state (wave height)?
• Extreme wind speed?
• Extreme brightness due to low sun, 24 hours per day?
• Seismic (volcano, earthquake) effects?

Risk Control Measures and Risk Control Options
• Ice strengthening for ships.
• Ice forecasts.
• Availability of ice breakers.
• Navigation aids that fully function in polar waters.
• Equipment and systems that function correctly, and on demand, in extreme cold.
• Additives for fuel to prevent waxing (prevent failure or failure on demand).
• Restricted bunker fuel oil type(s).
• Stricter routine discharge limits compared to IMO baseline (MARPOL).
• Enforcement of discharge limits.
## Polar Code – Hazards Matrix previously prepared by IMO Work Group
(as supplied to DNV by IMO)

### Conditions/Areas of concern  Table 1 of 4 Environmental Conditions

<table>
<thead>
<tr>
<th>Potential Hazards</th>
<th>Possible consequences</th>
<th>Intermediate Result</th>
<th>Potential Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Low air temp</td>
<td>1.1.1 Loss of material performance</td>
<td>1.1.1.1 Side shell rupture</td>
<td>Water ingress – capsize – sinking – pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1.1.2 Side shell fitting failure</td>
<td>Flooding – machinery damage – capsize</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1.1.3 Rupture of deck piping</td>
<td>Pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1.2 Machinery [equipment] malfunction</td>
<td>System failure e.g. fire main</td>
</tr>
<tr>
<td></td>
<td>1.1.2.a Battery fails to start unit</td>
<td>1.1.2.1 Reduced manoeuvrability</td>
<td>1.1.2.1.1 Grounding, stranding, trapped in ice</td>
</tr>
<tr>
<td></td>
<td>1.1.2.b Electric contacts malfunction</td>
<td>Remote control failure, false alarms</td>
<td>Various</td>
</tr>
<tr>
<td></td>
<td>1.1.2.c Loss of working clearance - seizure</td>
<td>Fire flaps won’t close; cargo vents freeze fire</td>
<td>Fire uncontrollable; cargo over-pressure</td>
</tr>
<tr>
<td></td>
<td>1.1.2.d Loss of lubricant performance (high viscosity) - mechanical seizure</td>
<td>Rotating equipment starting problems</td>
<td>Emergency fire pump won’t start Emergency Generator won’t start</td>
</tr>
<tr>
<td></td>
<td>1.1.3 Freezing of fluid/cargo</td>
<td>1.1.3.1 Side shell rupture</td>
<td>Water ingress – capsize - sinking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1.3.2 Can’t discharge cargo</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>1.1.3.3 Cargo expands/contracts – structural damage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.3.3 Pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.4 Increased fluid viscosity – machinery – diesel engine</td>
<td>1.1.4.1 Fuel pumping difficulties</td>
<td>1.1.4.1.1 Loss of electrical and/or propulsive power</td>
</tr>
<tr>
<td></td>
<td>1.1.4.2 Increased fluid viscosity – machinery - hydraulic</td>
<td>1.1.4.2 Hydraulic deck equipment performance</td>
<td>1.1.4.2.1 Anchor and mooring line handling problems</td>
</tr>
<tr>
<td></td>
<td>1.1.4.3 Increased fluid viscosity - cargo</td>
<td>1.1.4.2 Cargo pumping difficulties</td>
<td>1.1.4.3.1 Can’t lighten ship in emergency</td>
</tr>
<tr>
<td>1.1 Low air temp</td>
<td>1.1.5 Effect of cold cargo on hull materials</td>
<td>1.1.1.1.1; 1.1.1.2 Pollution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.6 Loss of functionality of operating and emergency equipment</td>
<td></td>
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<tr>
<td></td>
<td>1.1.7 Loss of functionality of doors and closing appliances</td>
<td>Can’t access spaces; can’t close down spaces to prevent water ingress or to fight fire</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.8 Reduced survival time /hypothermia</td>
<td>Various</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.9 Reduced human performance, physical and cognitive functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.10 Ice on deck and superstructure</td>
<td>Loss of stability Loss of footing</td>
<td>List/capsize Personal accident, death</td>
</tr>
<tr>
<td></td>
<td>1.1.12 Limitation of SAR capabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.13 Increased hotel load??</td>
<td>Electric power shortage</td>
<td></td>
</tr>
<tr>
<td>1.2 Low water temp</td>
<td>1.2.1 Reduced survival time</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2.2 Malfunction of fluid systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2.3 Clogging of inlets &amp; outlets</td>
<td>Machinery malfunction 1.1.3.1.1</td>
<td></td>
</tr>
<tr>
<td>1.3 Extreme &amp; rapidly changing weather</td>
<td>1.3.1 Difficult to prepare for or avoid dangerous weather conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.3.2 Propulsion and/or</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference to part of this report which may lead to misinterpretation is not permissible
### Conditions/Areas of concern Table 1 of 4 Environmental Conditions

<table>
<thead>
<tr>
<th>Conditions/Areas of concern</th>
<th>Table 1 of 4 Environmental Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>manoeuvring Difficulties</strong></td>
<td><strong>1.3.3 Reduced survivability/ Hypothermia</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.3.4 Increased risk of human error</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.3.5 Injuries due to ice flow/falling on deck</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.3.6 Capsize and operational threats to smaller vessels, auxiliary boats and tenders</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.3.7 Limitation of SAR capabilities</strong></td>
</tr>
<tr>
<td><strong>1.4 Presence and variability of sea ice</strong></td>
<td><strong>1.4.1 Structure failure due impact with ice or pressured ice</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.4.2 Hull penetration</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.4.3 Hull structure deformation,</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.4.4 Disturbance in navigation due to ice bergs</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.4.5 Propulsion and/or manoeuvring difficulties/failure</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.4.6 Different stability characteristics in ice</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.4.7 Damage to anti collision systems</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.4.9 Inability to operate evacuation systems due to surrounding ice</strong></td>
</tr>
<tr>
<td><strong>1.5 Ice on deck and superstructures</strong></td>
<td><strong>1.5.1 Reduced stability,</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.2 Mal-or no function of equipment and systems (incl LSA and FP) on deck</strong></td>
</tr>
<tr>
<td><strong>1.5 Ice on deck and superstructures</strong></td>
<td><strong>1.5.3 Malfunction of navigational aids</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.4 Injuries to personnel</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.5. Blocking of air intakes, air ventilation and pressure release valves</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.6 Exposure of personnel to de-ice (chemicals),</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.7 Possibility of damage to equipment during de-icing (hammer)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.8 Malfunctioning of deck machinery</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.9 Overload due to ice</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.10 Restrictions of human activities</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.5.11 Hypothermia</strong></td>
</tr>
</tbody>
</table>

### Conditions/Areas of concern Table 2 of 4 High Latitude

<table>
<thead>
<tr>
<th>Potential Hazards</th>
<th>Possible consequences</th>
<th>Intermediate Result</th>
<th>Potential Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Reduced navigational aids</td>
<td>2.1.1 Grounding, standing, trapped in ice</td>
<td>2.1.2.1 Injuries or fatalities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1.2 Impact with ice or other structures</td>
<td>2.1.3 Lack of signals/disturbance DGPS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1.4 Unstable gyro</td>
<td>2.1.4 Unstable gyro</td>
<td></td>
</tr>
</tbody>
</table>

Reference to part of this report which may lead to misinterpretation is not permissible
### Conditions/Areas of concern Table 2 of 4 High Latitude

<table>
<thead>
<tr>
<th>2.2 Varying availability of charts/hydrographical information</th>
<th>2.2.1 Grounding, stranding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.2.2 Voyage planning</td>
</tr>
<tr>
<td></td>
<td>2.3.3 Anchoring</td>
</tr>
<tr>
<td>2.3 Varying availability of charts/hydrographical information</td>
<td>2.3.1 Voyage planning</td>
</tr>
<tr>
<td></td>
<td>2.3.2 Difficult to prepare for or avoid dangerous weather conditions/ situations</td>
</tr>
<tr>
<td></td>
<td>2.3.3 Insufficient clothing and supplies (optimistic planning)</td>
</tr>
<tr>
<td>2.4 Variable infrastructure</td>
<td>2.4.1 Insufficient actions to incidents and accident</td>
</tr>
<tr>
<td></td>
<td>2.4.2 Insufficient spill preparedness</td>
</tr>
<tr>
<td></td>
<td>2.4.3 Limited compliance and enforcement (local infrastructure, waste reception facilitations)</td>
</tr>
<tr>
<td>2.5 Interference with long range electronic communications</td>
<td>2.5.1 Loss of possibility to send distress messages/contact SAR</td>
</tr>
<tr>
<td></td>
<td>2.5.2 No weather/ice forecast</td>
</tr>
<tr>
<td></td>
<td>2.5.3 Loss of communication possibilities</td>
</tr>
<tr>
<td>2.6 Variable communication capabilities</td>
<td>2.6.1 Communication difficulties</td>
</tr>
<tr>
<td>2.7 Limited search and rescue capabilities</td>
<td>2.7.1 Insufficient response to incidents and accidents</td>
</tr>
<tr>
<td></td>
<td>2.7.2 Lack of medical support</td>
</tr>
<tr>
<td></td>
<td>2.7.3 Capability of emergency source of electrical power.</td>
</tr>
<tr>
<td>2.8 Limited availability of oil spill preparedness</td>
<td>2.8.1 Insufficient response to spills</td>
</tr>
<tr>
<td></td>
<td>2.8.2 Damage to ecological systems</td>
</tr>
<tr>
<td></td>
<td>2.8.3 Damage to flora and fauna</td>
</tr>
</tbody>
</table>

### Conditions/Areas of concern Table 3 of 4 Environmental Sensitivity

<table>
<thead>
<tr>
<th>Potential Hazards</th>
<th>Possible consequences</th>
<th>Intermediate Result</th>
<th>Potential Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Discharges from normal operation</td>
<td>3.1.1 Damage on ice caused by soot</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.1.2 Environmental damage from grey water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Oil and chemical spill</td>
<td>3.2.1 Inability to operate pollution response</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Conditions/Areas of concern Table 3 of 4 Environmental Sensitivity

<table>
<thead>
<tr>
<th>Systems due to surrounding ice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Note 3.2.1 is not a consequence - it’s a hazard??</strong></td>
</tr>
</tbody>
</table>

### 3.3 Air Pollution

<p>| |</p>
<table>
<thead>
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</table>

### Conditions/Areas of concern Table 4 of 4 Human Element

<table>
<thead>
<tr>
<th>Potential Hazards</th>
<th>Possible consequences</th>
<th>Intermediate Result</th>
<th>Potential Result</th>
</tr>
</thead>
</table>
| 4.1 Lack of knowledge of personal protection | 4.1.1 Frostbite  
4.1.2 Hypothermia |  |  
| 4.2 Unfamiliarity of polar environment |  |  |  
| 4.3 Working environment |  |  |  

Reference to part of this report which may lead to misinterpretation is not permissible
Appendix II : Workshop Outputs

This appendix contains the outputs from the workshop. These outputs were recorded on-line during the workshop and were subject to initial review by the workshop participants at that time. The outputs were then categorised and edited for clarity and format by DNV and circulated by email to workshop participants for further review. The outputs recorded below are the proposed final workshop outputs including comments received via email from the workshop participants.

1.0 Brainstorm Session 1: List of Impacts to the Environment

The aim of Brainstorm Session 1 was to identify:

- All routine releases of materials into the environment. This includes both continuous releases and intermittent releases that are consistent with normal ship operating procedures.
- All accidental releases of materials into the environment. The main focus will be on navigational accidents to ships (collisions, groundings, etc.).
- Any other cause of potentially significant release of material into the environment or any other type of environmental impact caused by the presence of shipping.

During the workshop it was noted that the list below should be correlated with existing lists in order to ensure the list of impacts to the environment is exhaustive. This has not yet been done.

Sound, Vibration, Light
- Noise (e.g. echo sounders)
- Light from ships
- Propulsion noise
- Disturbance to indigenous people
- Disturbance of wildlife from physical presence (intrusion)
- Seismic guns/seismic explosion (defined as out of scope of this workshop)

Dirty Water
- Blackwater
- Deck drainage (runoff)
- Greywater
- Operational oil release
- Coatings (e.g. anti fouling, abraded coatings)
- Cargo residues (e.g. tank washing)
- Damage control releases (e.g. fire water, flooding)
- Bilge water
- Ballast water
- Cooling water (chemicals, temperature difference)
- Stern tube lubricant release
- Deck machinery leakage
- Electrochemical control of corrosion
- Deicing fluids associated with aviation, etc.
- Heavy metal contaminants/active substances in ballast water

**Emissions to air**
- Combustion gases, such as SO\textsubscript{x}, NO\textsubscript{x}, CO\textsubscript{2} soot, VOCs, heavy metals
- Incinerator emissions, including poly-chlorinated biphenyls (PCBs) and dioxins
- Cargo vapours (e.g. cargo tank vents)
- Ozone depleting substances (e.g. fire fighting systems, air conditioning, refrigeration)

**Solid Waste**
- Waste food and garbage
- Fishing debris (lost or discarded equipment, discarded fish)

**Other Environmental Impacts**
- Broken ice impacting wildlife (e.g. by drowning of land animals or crushing)
- Life cycle impacts of non-standard ships (e.g. materials, energy consumption)
- System efficiency (e.g. emission control systems have energy cost)
- Route selection and relative carbon usage
- Legal dumping (e.g. sediment, dredged material, ships, ocean fertilization, jettisoning cargo in an emergency)
- Landing operations (e.g. helicopter transfers, small boats)
- Human footfall related impacts
- Regulation of abstraction of water into sea chest to prevent disturbance of marine fauna
- Anchoring outside approved anchoring areas causing unintended damage to the seabed
- Thermal energy release into the environment
- Effluents from gas cleaning systems

**Invasive Species**
- Alien species on hull and in ballast water when exchanged
- Rats, dogs, etc.

**Impacts from Accidents**
- Accidental loss of ship products (fuel, lubrication oils, hazardous and noxious substances), cargo (hazardous and noxious substances, containers), sunken ship
- Radioactive materials e.g. accident in nuclear powered ice breakers
- Radioactive cargo
- Damage to sensitive habitats e.g. through physical damage or spills
- Dispersants in response to a spill
- Ship strikes of wildlife

### 2.0 Brainstorm Session 2: List of Risk Controls

The aim of Brainstorm Session 2 was to identify all potential hazard causes, hazard consequence modification factors and safeguards (risk controls) that could apply in the polar waters.

It was also noted that under the International Safety Management (ISM) code, that is mandatory for the majority of shipping, shipping companies already have the responsibility to...
select and train their crews to meet standards of motivation and competence, and to minimise the environmental impact of their operations from routine, intermittent and accidental events.

Controls for Improved Ships Design

- Ice strengthening of ships
- Taking the environment into account when designing ship systems (e.g. more efficient combustion systems, low emission burners, etc.)
- Fuels with lower carbon content (e.g. LNG, LPG, nuclear)
- MARPOL Annex 6 (improved efficiency)
- Limited size of fuel oil tanks, or greater sub division of tanks
- Damage stability and other survivability requirements
- Improved reliability of ship systems, especially improved reliability in extreme cold and/or ice
- Larger waste carrying capacity (so waste can be offloaded in safer locations)
- Use of water instead of oil based hydraulic fluids
- Stern tube lubricated with water
- Treatment systems for waste streams to reduce their environmental impact
- Appropriate hull residual strength for the conditions
- Designing lights on ships to minimize environmental impact (especially for sea birds)
- Restrictions on routine emissions (e.g. where, how much, maximum concentration, etc.)
- Best material selection for ship components where parts may be lost into the environment
- Improved propeller design to reduce propeller noise
- Sufficient engine power to operate in ice
- Improved availability/operability of equipment in cold temperatures
- Equipment designed to be easy to use in cold environment (e.g. when wearing heavy gloves)
- Improved ice detection capability e.g. radars
- Load monitoring systems to detect stresses in ship
- Sonar to detect underwater ice both in front of and to the sides of the ship
- Systems to detect thickness of ice
- Design ships for the ease of removal of pollutants from sunken ships
- Adequate ship lighting for permanent winter operations
- Improved ship maneuverability and crash stop capability

Controls for Improved Ship Operations

- Improved shift patterns to minimise fatigue
- Limited quantity of materials carried on board ship
- Use of less polluting fuel categories
- Speed limits for reducing fuel consumption
- Oil recovery systems to be carried aboard ships
- Leak preventers
- Ice breaker escorts
- Crew training
- Reduced speed to reduce impact due to fauna strikes
- Voyage planning to minimise environmental impacts
- Rules to separate ships from glacier fronts to minimise risk from calving
- Zero harmful discharge where appropriate
• Standardisation of fuel, water transfer couplings, booms to minimise spills from ship-to-
ship transfers
• Adequate low temperature performance of equipment and consumables e.g. fire
fighting foams
• Slower steaming speeds to reduce likelihood of hull penetration in the event of an
accident
• Knowledge of shipboard damage control by crew
• Ability to make temporary minor hull repairs by crew (if appropriate)
• Potable pumps and hoses to allow products to be pumped off a damaged vessel
• Anti-icing measures (e.g. steam hoses) to respond to heavy icing due to, for example,
  frozen spray
• Procedures for safe operation of auxiliary craft (inflatables, helicopters)
• Non biocide antifouling systems
• Crew selection based on experience and training
• Oil spill contingency plan specific to the ship
• Improved cargo storage and lashing to prevent loss or movement which might impact
  on stability
• Fuel handling management during ship-to-ship fuel transfers

**Controls for Improved Ship Support Systems**

• Better hydro-geographical data to improve navigation and to avoid higher risk situations
• Aids to navigation e.g. better satellite coverage
• Traffic limitations (e.g. numbers, locations, time of year, routes, designation of areas to
  be avoided, etc.)
• Real time ice information and ice forecasts
• Knowledge and real time information about wildlife habitats and movements
• Taking account of seasonality in all mitigation measures
• Robustness of communication (availability, bandwidth, speed)
• Meteorological data now and forecast, including visibility, temperature, wind and sea
  state
• Search and rescue, particularly identification of current location of ship and spill
  response
• Traffic monitoring systems
• Preposition of equipment to respond to spills
• Improved waste reception facilities
• Availability of information to the ship to avoid disturbance to wildlife e.g. particularly
  significant migration routes, sensitive ecological areas, feeding and breeding areas,
  interaction, etc.
• Improved pilot books and navigational information
• Reduced work schedules to avoid fatigue
• Availability of pilots and ice navigators
• Improved responder training and cooperation within the littoral states or nearest
  neighbouring states
• Easy access to ship structure data within and off the ship
• Provision of information on ship movements to local communities
• Ice management i.e. keeping paths open

**Other Controls**

• Regulation, company and industry guidance
• Common yardstick for rating vessel strength
Management practices to limit the introduction of non-native species
Life saving equipment
 Provision of wildlife monitors on ships
Ensuring ships have the ability to respond to other ships in the case of drift, accident or spill

Finally, it was suggested that existing ships could be required to comply with standards applied to new ships. This suggestion was disputed.

3.0 Analysis of Hazards Identified

Selected hazards identified in the first brainstorm session were analysed according to the spreadsheet template that had been pre-developed by DNV and adapted during the workshop as required.

The outputs, including comments received from the workshop participants, are shown in Table 1 (Hazard Analysis)

4.0 Brainstorm Session 3: Benefits of Increased Shipping in Polar Waters

The aim of this session was identify benefits from increased shipping traffic in polar waters, in order to deliver a more balanced report.

Benefits from increased shipping in polar waters
- Reduced environmental impacts from reduced voyage distances (reduced fuel consumption and associated impacts)
- Economic benefits to shipping companies
- New trade relationships between Europe and Asia
- Sustainable development for Northern communities providing support to Northern economies e.g. port development
- Awareness and education for visitors in polar regions
- Collection and distribution of scientific information from the use of ships of opportunity (weather, hydrographic data collection, etc)
- Access to natural resources
- Greater international cooperation of polar States, e.g. search and rescue operations

The following additional possible benefits were notified to DNV outside of the workshop process:
- Higher resolution monitoring of areas for illegal activities, such as illegal unregulated and unreported fishing in the Southern Ocean
- A higher ship traffic can only improve the search and rescue assets in the polar waters
5.0 Brainstorm Session 4: Suggestions for Workshop Process Improvement

At the end of the workshop DNV requested that the workshop participants considered how the workshop process could have been improved. The following suggestions were made:

- The group could have been split into smaller focus groups with representatives from various stakeholder groups to increase speed.
- Some columns in the hazard analysis tables (Appendix II, Section 3) such as ‘current controls’ could have been pre-populated to increase the efficiency of the workshop process.
- Awareness of the current drafting of the Polar Code during the workshop planning process might have avoided duplication and repetition during the workshop.
- Previous work within the group could have been studied prior to the workshop to avoid duplication and repetition during the workshop.
- Inclusion of more scientists might have helped the process, especially the discussion of impacts.

DNV and IMO closed the workshop by thanking all participants for their attendance and their contributions.
Appendix III : Analysis of Hazards Performed after the Workshop

Unfortunately there was not sufficient time during the workshop to complete the analysis of all the main hazards identified. This appendix contains the proposed hazard analysis which has been performed by DNV in order to complete the process that could not be completed during the workshop.

Additional selected hazards identified in the first brainstorm session were analysed according to the spreadsheet template that had been pre-developed by DNV and adapted during the workshop as required.

The outputs of this additional analysis are shown in Table 2 (Post-Workshop Additional Hazard Analysis performed by DNV)
Appendix IV : Additional Submissions from Workshop attendees

The workshop included participants with a range of experiences, expertise and perceptions. In some cases these led to differences of opinion between participants. Where feasible, these differences have been noted in the workshop outputs, for example by the inclusion of the word “disputed” after a statement. This section records statements as received from participants after the workshop so that different positions were recorded in full.

Submissions were received from the following workshop participants and they are reproduced in full below:

- Clean Shipping Coalition (CSC).
- International Fund for Animal Welfare (IFAW).
- Friends of the Earth International (FOEI).
- Pacific Environment.

The World Wildlife Fund (WWF-International) expressed their support for the above submissions.
Clean Shipping Coalition

October 14, 2011

The Clean Shipping Coalition appreciates the opportunity to submit this document to the Annex of the Workshop Report on impacts of shipping in the polar regions.

We will not reiterate our comments from the Workshop, but instead highlight some of our main concerns. CSC also re-affirms our support for the content and recommendations of the coalition briefing document “Environmental Protection for Polar Waters – Proposals for provisions for inclusion in an environmental protection chapter of the mandatory Polar Code” that was submitted previously by conservation organizations, including members of CSC.

With climate change and other activities already placing stress on our polar regions, it is imperative that any additional industrial activity in these regions be undertaken in a precautionary manner that ensures the protection of ecosystems. As you are aware, industrial shipping is a primary source of marine ecosystem degradation globally and the expected increase in traffic in the polar region has the potential to cause major impacts. Potential impacts include oil spills, invasive species introduction, marine mammal strikes, air, water and noise pollution and accelerated arctic warming from BC deposition. Recent studies on both polar regions highlight the importance of developing a mandatory polar code that prioritizes the protection of these remote and unique environments. As highlighted in the recent Arctic Marine Shipping Assessment:

[The Arctic marine environment is especially vulnerable to potential impacts from marine activity.]

The polar regions require heightened protections for many reasons. The Arctic, for example, is an important habitat for a multitude of species that either live there year round or migrate to the region. The extreme Arctic climate has led to a regional ecology that is characterized by animals that store energy when food is plentiful and fast when it is not; animals with highly insulating outer layers such as feather, fur or blubber; and a high degree of seasonal migration to and from the region, particularly by marine mammals and birds. Seasonal migrations that feature critical life stages in Arctic waters (such as feeding, breeding, mating, or nurturing young) make these species particularly vulnerable to the impacts of Arctic shipping.

Furthermore, fur and feathers, which are critical to survival in this cold climate, are especially at risk from contamination by oil spills.\(^5\)

The polar environments, and especially the Arctic, are particularly sensitive to climate change. The Arctic is warming faster than the rest of the planet, twice as rapidly as the global average.\(^6\) These significant temperatures increases result in a rapid melting of Arctic land and sea ice. While the impact of CO\(_2\) emissions on this warming pattern is undeniable, it is important to recognize the particularly important influence of other air emissions such as black carbon (BC). Black carbon is a strongly light-absorbing component of particulate matter and is emitted as a result of the incomplete combustion of fuel. A paper by Drew Shindell from the NASA Goddard Institute for Space (GISS) and Greg Faluvegi from the Columbia University notes that the Arctic strongly responds to BC emissions and that BC could even account for 50 per cent of the Arctic warming.\(^7\) The BC warming effects are magnified when black carbon deposits on the ice cap and changes the reflectivity of Arctic snow and ice.

International shipping is an important contributor of BC emissions, accounting for around 2\% of the global BC emissions. As most shipping activities occur in the northern hemisphere and as new sea routes open in the Arctic, the impact of these emissions on the Arctic environment may well be greater and increase further. Because of the strong and near-term warming effects of BC in the Arctic and the rapid warming of that region, it is particularly important to reduce emissions of BC, most particularly emissions of BC from far-north locations where the pollution is most likely to reach the Arctic.

A recent study has established various Arctic emission inventories for black carbon, taking into account the predicted growth of regional shipping and the potential diversion of global traffic to the emerging Arctic sea routes. The report concludes that without control measures, BC emissions will increase in all future scenarios: from 0.88kt per year in 2004 to between 2.7kt per year (under a business as usual scenario) to 4.7kt per year (under a high-growth scenario) by 2050.\(^8\)

MEPC 62 recently adopted a work-plan to address the issue of black carbon emissions within the IMO. While this process is of high importance for the organization, CSC considers that the environmental chapter of the mandatory Polar Code must also recognize and reflect the particular importance of black carbon emissions for the polar environment.

Given the significant sensitivity of the polar ecosystem, the Polar Code should aim at the maximum level of environmental protection. Some measures have already been adopted by the IMO for other special circumstances such as Particularly Sensitive Sea Areas (PSSAs) or Emission Control Areas (ECAs), and they should serve as a basis to develop some sections of the environmental chapter of the Polar Code. As an example, the ban of heavy fuel oil, which has been introduced in the Antarctic, should be extended to all polar waters, as it will produce

\(^6\) Document MEPC60/4/24, Reduction of emissions of black carbon from shipping in the Arctic, submitted by Norway, Sweden and the United States, Pg 2
\(^7\) Shindell et Faluvegi (2009), Climate response to regional radiative forcing during the twentieth century, Nature Geoscience, VOL 2, APRIL 2009, pp 294-300
\(^8\) Corbett et al. (2010): Arctic shipping emissions inventories and future scenarios, 10 Atmos. Chem. And Phys. 9689-9704
significant benefits in terms of oil spill prevention and air pollution reduction. Regulated speed or special technical measures could also be considered.

Thank you again for a productive workshop and we look forward to our continued collaboration.
Comment on IMO Polar Hazard Identification Workshop draft output
International Fund for Animal Welfare (IFAW)

General comments

IFAW continues to work on the environmental aspects of the Polar Code with other NGOs with consultative status at the IMO, including FOEI, WWF, Pacific Environment and CSC. An identification of hazards to the environment and potential controls are summarised in the joint Briefing “Environmental Protection for Polar Waters – Proposals for provisions for inclusion in an environmental protection chapter of the mandatory Polar Code”\(^9\). The Briefing includes twenty-four recommendations that are effectively a joint priority list for additional controls to ensure that the requisite management is put in place to ensure protection of polar waters and the ecosystems and wildlife they support.

IFAW has particularly focussed on impacts of shipping on marine mammals and especially on ship strikes and underwater noise pollution. We were involved in developing the IMO guidance on minimising the risk of ship strikes with cetaceans (MEPC.1/Circ.674) and also actively involved in the MEPC correspondence group on noise from commercial shipping and its adverse impacts on marine life.

Both ship strikes and underwater noise pollution from shipping are a global problem and IFAW welcomes the IMO efforts to address these at a global level. However, there are some specific aspects of these problems to polar waters making it necessary for these to be addressed within the Polar Code.

Comments on workshop output

The outputs of the workshop reflect discussion of areas where further information is required. On the effects of sonar and the influence of shipping on marine animals with respect to collision, items 4 and 5 from the table (below) reflects a lack of agreement on whether more information is needed.

Table from IMO Analysis(Cleaned)05Oct11.xls sheet General Comments

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<td>4</td>
<td>Sonar frequencies which are a problem for marine animals (disputed as it is felt that sufficient information is available, precautionary principle)</td>
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<tr>
<td>5</td>
<td>Influence of shipping on marine animals with respect to collision (disputed as it is felt that sufficient information is available, precautionary principle applies)</td>
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Although there is considerable uncertainty about the effects of sonar on marine life, it has been clearly demonstrated that certain sonar signals have had direct impacts on some species of whales. The use of high intensity sonar is often subject to Environmental Impact Assessment that may require mitigation measures to be taken to reduce effects on marine mammals. Within the EU the Marine Strategy Framework directive includes indicators for Good Environment Status based on loud, low and mid frequency impulsive sounds over the frequency bands of 10Hz to 10kHz. Sonars operating at higher frequencies are generally not regulated but nevertheless overlap with frequencies known to be used by cetacean species.

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Reference to part of this report which may lead to misinterpretation is not permissible
Wherever the distribution of shipping and marine mammals overlap there is a risk of collision. The International Whaling Commission maintains a global database of collisions between vessels and cetaceans which suggests that most species are vulnerable to collisions and collisions occur with a wide variety of vessel types. In some polar areas there is sufficient data on seasonal concentrations of marine mammals to identify areas where there would be a high risk of collision if substantial numbers of ships were to transit the area.

IFAW supports further research on ship strikes and effects of noise but it is important to recognise within the Polar Code that there is already sufficient evidence to demonstrate that these are significant threats that need to be addressed. The real research needs are to develop more effective ways of mitigating these threats. This is the approach that the IMO has taken globally with respect to developing guidelines for reducing underwater noise.

In addition in Polar Regions several marine mammal populations are subject to direct takes. In the Arctic, the numbers of gray and Bowhead whales taken by indigenous hunters from Russia and the USA is set by the International Whaling Commission using a management procedure approach that balances human needs against conservation impacts. Catch limits for these populations may need to be reduced to take account of any additional human caused mortalities from ship strikes.
Response to
IMO Polar Hazard Identification Workshop draft output
Friends of the Earth International
(FOEI)

Statement

FOEI\(^{10}\) has previously elaborated on the measures considered necessary for the protection of polar environments from the impacts of vessels operating in Polar Regions via a range of submissions to IMO’s Marine Environment Protection Committee and the sub-committee of Ship Design and Equipment\(^{11}\) (see Annex I). Over the past two – three years as work has commenced to develop a mandatory Polar Code, FOEI has worked closely with the other environmental NGOs with consultative status at the IMO, including IFAW, WWF, Pacific Environment and CSC, and co-sponsored a number of submissions addressing environmental aspects.

We continue to work closely on the environmental aspects of the Polar Code and our identification of hazards to the environment and potential controls are summarised in the Briefing “Environmental Protection for Polar Waters – Proposals for provisions for inclusion in an environmental protection chapter of the mandatory Polar Code”\(^{12}\). The Briefing includes twenty-four recommendations (see appendix) which are effectively our priority list for additional controls to ensure that the requisite management is put in place to ensure protection of polar waters and the ecosystems and wildlife they support.

FOEI was pleased to be able to participate in the IMO Polar Hazard Identification Workshop and to have the opportunity to comment on the draft outputs from the workshop.

Lack of data and precautionary approach

One issue raised repeatedly during the workshop was the lack of data and information on the impact of environmental hazards and therefore the difficulty of determining appropriate additional controls. The lack of data and information is an inevitable, not only because these have been some of the last regions of the planet to be explored and studied, but also because there has been comparatively less shipping access in these regions than other seas areas. This is however changing, new shipping routes are opening up and greater access is possible as a result of diminishing sea ice cover in both the Arctic and the Antarctic peninsula region. It is these changes that have prompted the need for a mandatory Polar Code, and FOEI advocates that a precautionary approach is required. In particular, as it has already been recognised that these regions are more sensitive due to their remoteness, long periods of light and of dark and coldness which will slow down the degradation of many types of pollutants and because they also support some of the greatest concentrations of wildlife on the planet, for example, 80% of the world’s great whales spend time feeding in remote Antarctic waters. As a result, it is necessary to extrapolate understanding of environmental hazards and their impacts from what is known from other parts of the world and then to apply precautionary approaches

\(^{10}\) FOEI collaborates with the Antarctic & Southern Ocean Coalition (ASOC) to address the impact and management of shipping in polar waters.

\(^{11}\) MEPC 59/20/7, MEPC 62/4/6, MEPC 62/11/6, MSC 86/23/19, DE 53/18/3, DE 54/13/8, DE 54/13/9, DE 55/12/8, DE 55/12/9, DE 55/12/16, DE 55/12/17, DE 55/12/18, DE 55/12/19, DE 55/12/20, DE 55/12/21


in the management of these hazards in polar waters – we cannot wait until complete data sets
and further information is available on the actual impact of increased levels of shipping or
increased access to previously inaccessible waters. FOEI noted, during the workshop, that the
IMO has developed guidelines on the application of the precautionary approach, and one
approach to consider would be applying these guidelines to a specific area of environmental
impact or potential impact.

Analysis gaps

Inevitably in the time available it wasn’t possible for the workshop to complete the analysis of
all the environmental hazards identified during the brainstorming. Some are of lesser
relevance, however there are a number of areas that FOEI believes have the potential for
significant impact in polar regions. In the environmental NGO submissions to IMO meetings
and in the environmental NGO Briefing referred to above we have identified those
environmental hazards we consider to be priorities, including:
- prevention of and response to oil and chemical spills, including ship design, equipment,
  and training along with monitoring of vessels, traffic routeing schemes, identification of
  areas to be avoided, search and rescue and preparedness and response,
- routine discharges of oils, chemicals, sewage and related wastes, grey water, garbage
  including litter and food wastes, air emissions including SOx, NOx, incineration
  emissions and black carbon,
- loss of packaged dangerous goods / containers,
- introduction of alien species,
- releases of toxic biocides,
- underwater noise,
- ship strikes and damage to habitats.

We recognise that not all these areas of priority will be of equal relevance to both Arctic polar
waters and Antarctic polar waters, for example, the Antarctic is already designated as a
Special Area under MARPOL 73/78 with respect to routine discharges of oils and a ban on the
 carriage and use of heavy fuel oil in Antarctic waters has been introduced.

In terms of the analysis undertaken in the workshop many of these areas were addressed in
some detail, however FOEI believes that the following are priorities for further attention:
  * introduced species (via ballast, fouling and / or onboard pests)
  * air emissions in particular black carbon,
  * garbage, in particular food wastes (as plastic garbage is banned anyway), and
  * biocide antifouling releases.

Proposed additional controls relevant to these areas are outlined in the Environmental
Protection for Polar Waters – Proposals for provisions for inclusion in an environmental
protection chapter of the mandatory Polar Code Briefing.

Feedback on draft Workshop output

It would be useful to include the aims of the workshop in the cleaned up version of the
Workshop Brainstorm.

Analysis
SOx – During the workshop, we struggled somewhat in considering SOx emissions – not least because it was the first hazard we analysed. SOx and NOx deposition appears to be more of a problem in coastal waters. See the following excerpt from Doney et al., 2007, which is cited in the eNGO Environmental Briefing.

“When nitrogen and sulfur compounds from the atmosphere are mixed into coastal waters, the researchers found, the change in water chemistry was as much as 10 to 50 percent of the total changes caused by acidification from carbon dioxide.”

This is an example of an area where it is necessary to extrapolate to determine likely affect in polar waters though some of the figures indicate that the Arctic (or at least parts of it) appears to be affected by sulfur/nitrogen deposition. Health impacts are another reason for SOx control.

The identification of heavily used areas within polar waters coupled with restrictions in these areas, where the concentration of shipping is more likely to create SOx impacts, would be another form of control. This would be complimented by monitoring by national governments, the Arctic Council and Antarctic Treaty Parties of NOx/SOx deposition from vessels and the effect on polar sea acidification would be valuable.

Greywater – the analysis refers to the need for further understanding of the impact. An extract from the eNGO Briefing is given below:

“Discharges of grey water, the wastewater from galleys, showers, laundries, as well as food pulp, represent an environmental concern for polar waters. The U.S. Commission on Ocean Policy reported in 2004 that an average cruise ship produces 3.8 million liters of grey water each week. Substances found in grey water include faecal coliform bacteria, oil and grease, detergents, nutrients, metals, food waste, and medical waste. Analyses by U.S. EPA and the Alaska Department of Environmental Conservation indicated fecal coliform levels of 36,000,000 CFU/100mL and 2,950,000 MPN/100mL, respectively, for untreated cruise ship grey water, which is higher than, by orders of magnitude, bacteria levels identified in untreated domestic wastewater. Grey water also has potential to cause harmful environmental effects due to concentrations of nutrients and other oxygen-demanding materials.”

Operational oil release(lines 7 & 8) – the 2nd bullet in the comment column refers to oily waste discharge being prohibited –this is purely in relation to MARPOL’s Special Areas Status for Antarctic waters.

There is further information available in the Environmental Protection for Polar Waters – Proposals for provisions for inclusion in an environmental protection chapter of the mandatory Polar Code Briefing prepared by the Antarctic & Southern Ocean Coalition (ASOC), Earthjustice, Friends of the Earth International (FOEI), International Fund for Animal Welfare (IFAW), Oceana, Pacific Environment and WWF (September 2011).

Annex 1:  eNGO submissions to IMO Committees and sub-committees

MEPC 59/20/7  Mandatory Polar Code submitted by FOEI, Greenpeace, IFAW and WWF
MEPC 62/4/16 Reduction of emissions of Black Carbon from shipping in the high northern latitudes submitted by CSC, FOEI, Pacific Environment and WWF
MEPC 62/11/6 Arctic Shipping and Cetaceans: recommendations regarding mitigation measures and the development of the mandatory Polar Code submitted by WWF, FOEI, and IFAW
MSC 86/23/19 Mandatory Polar Code submitted by FOEI, Greenpeace, IFAW and WWF
DE 53/18/3  Shipping management issues to be addressed submitted by FOEI, IUCN, Greenpeace, IFAW and WWF
DE 54/13/8  Additional MARPOL provisions for the Polar Code submitted by FOEI, IFAW, WWF, Pacific Environment and CSC
DE 54/13/9  Wider environmental provisions for the Polar Code submitted by FOEI, IFAW, WWF, Pacific Environment and CSC
DE 55/12/8  Polar Code boundaries for the Arctic and Antarctic submitted by FOEI, IFAW, WWF and Pacific Environment
DE 55/12/9  Vessel monitoring and traffic system submitted by FOEI, IFAW, WWF and Pacific Environment
DE 55/12/16 Harmful substances in packaged form and containers in Arctic waters submitted by FOEI, IFAW, WWF and Pacific Environment
DE 55/12/17 Polar Code boundaries for the Atlantic side of the Arctic submitted by FOEI, IFAW, WWF and Pacific Environment
DE 55/12/18 Reducing black carbon emissions from vessels in the Polar Regions submitted by FOEI, CSC, IFAW, WWF and Pacific Environment
DE 55/12/19 Definition of pollutant submitted by FOEI, IFAW, WWF and Pacific Environment
DE 55/12/20 Sewage and sewage-related discharges in polar regions submitted by FOEI, IFAW, WWF and Pacific Environment
DE 55/12/21 Voyage management and cetaceans submitted by FOEI, IFAW, WWF and Pacific Environment
Appendix: Environmental protection recommendations extracted from Briefing on Environmental Protection for Polar Waters – Proposals for provisions for inclusion in an environmental protection chapter of the mandatory Polar Code

Recommendation 1: The development of a mandatory Polar Code should comprehensively address all forms of potential impact from vessels operating in polar waters and ensure that the highest possible environmental standards are applied.

Scope of the Code
Recommendation 2: Where appropriate, and particularly in an environmental protection chapter, the Polar Code should refer to “oil and other harmful substances” and include a definition of harmful substances drawn from the definition in the MARPOL Convention.
Recommendation 3: In the development of the Polar Code it should be recognized that the MARPOL Convention is not the sole IMO instrument providing environmental protection provisions, nor is it necessarily limited to only the substances currently regulated. Other instruments include the Ballast Water Management Convention and the Anti-fouling Systems Convention.

Environmental Protection
Recommendation 4: The Polar Code should recognize the value of accident mitigation measures such as traffic routeing and separation schemes, areas to be avoided, speed restrictions, and mandatory ship location reporting.
Recommendation 5: The designation of Particularly Sensitive Sea Areas (PSSAs) should be considered along with associated protective measures tailored to each region that address accident mitigation and environmental protection from routine discharges.
Recommendation 6: The ships’ Operating Manual should include procedures tailored to polar waters that address routine vessel discharges.

Infrastructure support and compliance
Recommendation 7: The Polar Code should recognise the value of regional vessel traffic monitoring and information systems to support environmental protection and safety.
Recommendation 8: The Polar Code should address the need for enhanced and coordinated search and rescue response and environmental emergency response in remote Polar Regions and take into account already formulated relevant agreements such as the Arctic Council’s SAR instrument.
Recommendation 9: The Polar Code should require that the shipboard oil pollution emergency plan contains tailored provisions for operations in remote and sensitive polar environments.
Recommendation 10: The Polar Code should address the currently inadequate mapping of hydrographic conditions in polar waters.
Recommendation 11: The Polar Code should address the availability and use of waste reception facilities in connection with provisions protecting the polar environment from Annex I, II, IV and V wastes.

Measures focused on MARPOL and MARPOL related wastes
Oils
Recommendation 12: The Polar Code should ban vessel discharges of oil or oily mixtures into Arctic waters, providing equivalent protection to that already in existence for Antarctic waters (MARPOL Annex I, Regulation 15(b)(4)).

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Recommendation 13: The Polar Code should introduce a provision eliminating the use of heavy fuel oil (equivalent to MARPOL Annex I, Regulation 43 for the Antarctic Area) and restricting the carriage of heavy fuel oil by vessels in certain ecologically sensitive Arctic waters due to the threat of substantial and irrevocable environmental harm.

Noxious Liquid substances in bulk
Recommendation 14: Vessel discharges of noxious liquid substances or mixtures containing such substances into Arctic waters should be prohibited as they are for Antarctic waters in MARPOL Annex II, Regulation 13 (8).

Packaged dangerous goods and containers
Recommendation 15: The Polar Code should include heightened standards regarding harmful substances in packaged form and all containers to prevent loss and facilitate recovery, if feasible. (See Annex p14/15 for more detail on options to be considered).

Sewage, sewage sludge and grey water
Recommendation 16: Heightened protection and standards for discharges of sewage, sewage sludge and grey water should be included in the Polar code, in combination with testing, monitoring, recordkeeping, reporting, and enforcement requirements.

Garbage
Recommendation 17: All garbage, including food wastes, should be banned from discharge in both Arctic and Antarctic waters.

Air emissions – SOx and NOx
Recommendation 18: Enhanced NOx and SOx emission control measures including identification of potential emission control areas (ECAs) should be established.

Air emissions – incineration
Recommendation 19: There should be a ban on incineration in specially vulnerable areas of the Arctic and Southern Ocean, such as marine protected areas or other ecologically sensitive areas and within a specified distance, e.g. 12 nm, from the ice-face and / or land.

Air emissions – black carbon
Recommendation 20: The Polar Code should include interim measures / guidance on reducing black carbon emissions while the issue is being considered further by the BLG and MEPC. Fifty percent reductions in black carbon emissions should be targeted immediately and seventy percent reductions should be sought in the medium term (i.e., 2018).

Measures focused on Non-MARPOL wastes and other impacts
Underwater noise
Recommendation 21: The Polar Code should seek to reduce vessel disturbance to marine life through ship noise reduction measures, including ship quieting technology identified in the IMO noise reduction guidelines (under development), speed restrictions, routing options and areas to be avoided (taking into account bathymetric features, endemic marine mammal underwater sound sensitivity and migratory corridors). Particular attention should be given to noise from icebreakers.

Ballast water discharges
Recommendation 22: The Polar Code should require that the provisions of the Ballast Water Management Convention are applied for all vessels operating in polar waters. There should be additional restrictions on ballast discharges due to the great potential for major ecological...
impacts from species introduced via ballast water as ice cover recedes and the seawater warms in response to climatic change in Polar Regions. Moreover, the IMO Biofouling Guidelines should be followed by all vessels operating in polar waters.

Anti-fouling systems
Recommendation 23: The Polar Code should require that the provisions of the Anti-Fouling Systems Convention are applied to all vessels operating in polar waters. Furthermore, consideration should be given to the need for further restrictions on alternative anti-fouling systems, particularly those which release biocides (which are persistent, bioaccumulative and toxic), due to the potential for major impacts on polar waters and non-biocidal anti-fouling systems should be used when practicable.

Ship strikes
Recommendation 24: The Polar Code should include a provision on the use of advanced voyage planning to avoid interactions, especially collisions, with cetaceans and other marine mammals. Possible courses of action for vessel operators could include avoiding areas that pose a high risk of collision or operating through these areas at a reduced speed (e.g., 10 knots). Efforts also should be made by vessel operators to not interfere with native subsistence hunting of marine wildlife.
Submission to the Annex of the Workshop Report Concerning Impacts of Arctic Shipping on Indigenous Peoples and Geographic Boundary issues

Pacific Environment respectfully submits this document concerning impacts of shipping on Arctic indigenous communities and the Polar Code boundary issue to the Annex of the Environmental Aspects of the Polar Code Workshop Report. We greatly appreciate the contributions of all participants to the Workshop and the opportunity to join in frank and productive discussions on the development of the Polar Code.

Over the past three years we have worked closely with other environmental NGOs, including Friends of the Earth International (FOEI), International Fund for Animal Welfare (IFAW), Clean Shipping Coalition (CSC) and World Wide Fund for Nature (WWF), to engage in the Polar Code correspondence group and to co-sponsor a number of submissions to IMO committees and sub-committees addressing environmental aspects of the Polar Code. Much of this joint work is summarized in the briefing by these groups to the Workshop, entitled, “Environmental Protection for Polar Waters – Proposals for Provisions for Inclusion in an Environmental Protection Chapter of the Mandatory Polar Code”. In this subsequent short submission we reiterate concerns specifically related to impacts of Arctic shipping on indigenous peoples, the need to prevent and mitigate negative impacts to these and other coastal communities, as well as concerns about the Polar Code geographic boundary.

Impacts on Indigenous Communities: We greatly appreciate that several presenters and participants, including states, expressed the importance of consideration of the impact of Arctic shipping on indigenous and other coastal communities. The Arctic Council recognizes that the Arctic is home to traditional cultures that have lived in the region since time immemorial. The Arctic Council’s authoritative 2009 Arctic Marine Shipping Assessment (AMSA 2009) recognizes that these communities, which continue to engage in a subsistence way-of-life, are largely coastal and extensively utilize marine resources. According to AMSA 2009:

The marine environment and marine resources have long sustained Arctic communities. Thus, Arctic settlement patterns demonstrate a strong marine influence. Local Arctic residents today depend heavily on marine resources for subsistence and the local economy. A combination of over-the-ice travel (i.e., using ice as a platform and means of travel for hunting and fishing) and boat transport (i.e., for fishing, hunting and travel) allows the use of large Arctic marine areas during much of the year. Life in the Arctic is dependent on movement and sea ice is integral to this movement in the high Arctic. Remote indigenous coastal communities are especially vulnerable to marine accidents as they risk losing not only their vital marine resources, but the natural foundation of their cultures and way of life.

Since the beginning of time Arctic coastal indigenous whaling captains and their crews have navigated Arctic waters. The oceans serve as a vital resource, providing foods which sustain them through harsh weather conditions. The negative impacts of shipping can have direct and knock-on effects to coastal indigenous communities. Examples include, but are not limited to the following: Ship strikes to marine mammals and ship noise can disrupt marine mammal behavior, both of which can disrupt subsistence hunting; planned and accidental discharges of oils, chemicals, sewage and waste can poison subsistence food sources; air emissions can cause local air pollution; planned and unplanned disembarkment by large cruise ships can overwhelm coastal communities and their infrastructure.

Moreover, Arctic indigenous peoples are on the front lines of climate change. As climate change rapidly unfolds in the Arctic, indigenous peoples are faced with problems such as
receding sea ice which brings increased shipping into their traditional waters. Problems such as greenhouse gases and air emissions will compound with the already devastating impacts of climate change. For example, due to the reduction in sea ice indigenous hunters are being forced to go further and further off shore to gain access to traditional foods, increasing the risks of hunting tremendously. The emissions of black carbon from ships operating in the Arctic quickens the melting of polar ice, harming subsistence hunting in the short run and inextricably deracinate indigenous culture in the medium and long run.

Pacific Environment believes that the IMO member states can and must address, prevent and mitigate the negative direct and knock-on impacts of Arctic shipping on indigenous peoples in the Polar Code. The identification of impacts of shipping on human populations is a relatively common occurrence at IMO, and it is imperative that harmful impacts of shipping to particularly susceptible populations of people in the Arctic be affirmatively addressed in the Polar Code.

Geographic Boundary: We regret that the Polar Code boundary issue was not discussed in the workshop. However, we greatly appreciate introductory remarks by a sponsor of the Workshop who unequivocally noted that this issue has not been resolved in the drafting of the Polar Code. Adequate coverage of large Arctic marine ecosystems is a requisite factor to the success of the Polar Code. For more details on these concerns, please see submission DE 55/12/8 from Pacific Environment, FOEI, IFAW and WWF.

Thank you again for a productive workshop and we look forward to our continued collaboration.

Shawna Larson        Doug Norlen
Alaska Program Director Policy Director
Pacific Environment   Pacific Environment
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